

549,962

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
24 February 2005 (24.02.2005)

PCT

(10) International Publication Number
WO 2005/017436 A2

(51) International Patent Classification⁷:

F28F

(21) International Application Number:

PCT/US2004/021317

(22) International Filing Date:

1 July 2004 (01.07.2004)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

60/486,071

10 July 2003 (10.07.2003)

US

(71) Applicant (for all designated States except US): **MID-WEST RESEARCH INSTITUTE [US/US]**; 425 Volker Boulevard, Kansas City, MO 64110 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KUTSCHER, Charles, F. [US/US]**; 13523 West 21st. Avenue, Golden, CO 80401 (US). **KOZUBAL, Eric, Joseph [US/US]**; 817 East Moorhead Circle, Apt. D, Boulder, CO 80305 (US).

(74) Agents: **WHITE, Paul, J. et al.**; National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

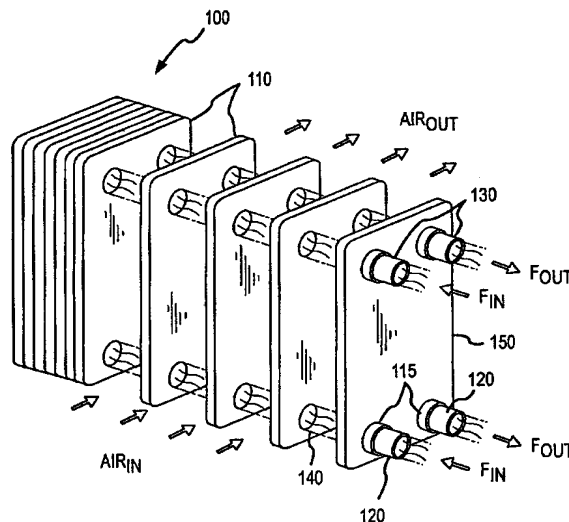
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— as to the identity of the inventor (Rule 4.17(i)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK,

[Continued on next page]

(54) Title: **TABBED TRANSFER FINS AND AIR-COOLED HEAT EXCHANGERS WITH TABBED FINS**



(57) Abstract: Heat transfer fins (110), and heat exchangers (100) incorporating such fins (110), enhancing heat transfer with acceptable pressure drop increase. The fins (110) include tabs or secondary fins bent upward and downward from the fin body at a selected bend angle. All or a majority of the tabs are aligned with a simple flow path or with local flow paths for cooling air adjacent the fins (110) to minimize turbulence and pressure drop. The tabs are planar and generally aligned parallel to the simple flow path or local flow paths and are arranged so as to serve as a plurality of sites for starting new boundary layers by offsetting the tabs such that downstream tabs are not shadowed by upstream tabs. The tabs have a height sufficiently large to extend the tabs out into boundary layers on the fin (110). The tabs provide more uniform flow over fins (110) and shrink wake size behind tubes (120).

WO 2005/017436 A2



LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

— of inventorship (Rule 4.17(iv)) for US only

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.